# NEW RULE FOR CUBE ROOT.

BY J. B. MOTT, WORTHINGTON, MINNESOTA.

IN the following example the ordinary method is pursued till the second figure of the root is found. We then find the triple product (t. p.) by placing the second figure of the root to the right of three times the preceding part of the root and multiplying this by said second figure, and so on for all the triple products, finding one from the other. Thus:

1st trial divisor + 1st t. p. = 1st complete divisor.

1st complete divisor+1st t. p.$+b^2+$2nd t. p. = 2nd complete divisor.

2nd complete divisor+2nd t. p.$+c^2+$3rd t.p. = 3rd com. divisor, &c., placing each t. p. two figures to the right under the preceding divisor; $b$, $c$ &c., being 2nd, 3rd &c. figures of the root.

Each complete divisor is used as a trial divisor for the next figure of the root. The constant left hand figures of any divisor, used as in simple division, will determine as many more figures of the root.

EXAMPLE.—To find the cube root of 2 to fourteen places of decimals.

| | | |
|---|---|---|
| First trial divisor = | 3 | 2(1.259921 |
| " t. p. = 32×2 = | 64 | 1 |
| " com. divisor = | 364 | )1000 |
| 1st t. p.+4+2d t. p., | 8625 | 728 |
| 2nd complete divisor, | 45025 | )272000 |
| 2nd t. p+25+3d t. p., | 218831 | 225125 |
| 3rd complete divisor, | 4721331 | )46875000 |
| 3rd t. p.+81+4th t. p., | 3731211 | 42491979 |
| 4th complete divisor, | 475864311 | )4383021000 |
| 4th t. p.+81+5th t. p., | 34765144 | 4282778799 |
| 5th complete divisor, | 47621196244 | )100242201000 |
| 5th t. p.+ 4 +6th t. p., | 79375561 | 95242392488 |
| 6th complete divisor, | 4762198998961 | )4999808512000 |
| 6th t. p.+ 0 +7th t. p., | 3779762 | 4762198998961 |
| 7th complete divisor, | 4762202778723 | )237609513039 |

Dividing, we have 2376095 ÷ 47622028 = .04989487+. This united to the root above gives $\sqrt[3]{2} = 1.25992104989487+$.

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REMARKS ON PROFESSOR JOHNSON'S QUERY BY R. J ADCOCK.—Mr. Jonson's paradox involves two questions, the value of $u$, and the value of $du \div dx = \cos ax$, when $a = \infty$. He says "now if $a = \infty$, $u = 0$ independently of $x$". This I deny. 0 is used to represent both actual zero and

infinitesimal quantities. It cannot however be so used unless it can be shown that no error will result from such use in the particular case. In this case when $a = \infty$, $u$ = actual zero or an infinitesimal, that is $u = 0 \div a$ or some infinitesimal between $1 \div a$ and $-1 \div a$, these infinitesimals depending for their values upon $a$ and $x$. And the rate at which these infinitesimals change their values is $du \div dx = \cos ax$, for all values of $a$ and $x$.

When $a$ is infinite, that is greater than any assignable number, then $a$ is indeterminately great, and by consequence indeterminate; $\cos ax$ is the cosine of an arc in a given circle, the arc being as indeterminate as $a$, and therefore $\cos ax$ is indetermiate both in "form" and value, and from the given conditions can no more be affirmed to be zero than any other value between $+1$ and $-1$. There being no preference or reason for the termination of the arc $ax$ in one part of the circumference rather than another. Mathematics having to deal with truth, like the "Scripture is of no private interpretation".

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## *DIFFERENTIATION OF THE LOGARITHM OF A VARIABLE.*

BY PROF. LABAN E. WARREN, COLBY UNIV., WATERVILLE, ME.

To differentiate the logarithm of a variable, let $y = e^x$;

$$\therefore x = \log_e y; \ \therefore dx = d(\log_e y).$$

$$y + dy = e^{x+dx},\ dy = e^{x+dx} - e^x \text{ or } dy = e^x(e^{dx} - 1),$$

$$e^{dx} = 1 + dx + \frac{dx^2}{2!} + \frac{dx^3}{3!} + \&c., \text{ or } e^{dx} = 1 + dx;$$

$$dy = e^x(1 + dx - 1), \text{ or } dy = e^x dx = y dx, \text{ or } dx = dy \div y,$$

but $dx = d(\log_e y)$;

$$\therefore d(\log_e y) = dy \div y, \text{ differential of Napierian logarithm.}$$

$$\log_{10} y = m(\log_e y); \ \therefore d(\log_{10} y) = m\, d(\log_e y);$$

$$\therefore d(\log_{10} y) = m\frac{dy}{y}, \text{ differential of common log.}$$

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## *SOLUTIONS OF PROBLEMS NUMBER TWO.*

Solutions of problems in No. 2 have been received as follows:

From Prof. L. G. Barbour, 434; Prof. W. P. Casey, 430, 431, 433; G. E. Curtis, 429, 434; Geo. Eastwood, 431; Wm. Hoover, 429, 430; Prof. P. H. Philbrick, 429, 430, 431, 433, 434; Prof. E. B. Seitz, 430, 431, 433, 435; Prof. J. Scheffer, 428, 430, 431, 433.